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HAND GESTURE PHASE CLASSIFICATION USING MULTILAYER PERCEPTRON

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ABSTRACT

Symbolic and Sign language is a most important technique for the non-verbal communication which uses the gestures i.e. the movement of the body part which carry some information to perform the desired goal. Gesture is a meaningful statements or information given by the human beings to accomplish the specific task. This paper presents an approach for Human-Computer Interaction (HCI) where we classify the different hand gesture phases using the movement of the hand as the input device. The main objective of this paper is to make a robust model to identify the different hand gesture phases using Multilayer Perceptron (MLP) with high accuracy.The MLP gives better classification accuracy as 83.95% with learning rate 0.6 and hidden layer 3.

KEYWORDS: Multilayer Perceptron, Hand Gesture, Human-Computer Interaction (HCI), Non Verbal Communication.

1. INTRODUCTION

Human-Computer interaction (HCI) also known as man-machine interaction. Human-Computer interaction has become very important part of our daily routines because we live in a digital era. Human-Computer interaction model can help in understanding what is going on when humans interact with a system and also understanding that how they interact with them. Hand Gesture is a way to communicate with such sensing devices and the user don't need to use any special physical hardware. The gesture phases segmentation is important for investigating issues such as the synchrony between speech and gestures, analysis related to gesture categorization, or how discourse is produced. Gesture is a communication bridge between the computers and human beings [1]. In other context, we can say that Gesture is any physical movement of the body part like hand, face, fingers and these movements carry information which is used to communicate with the computer system. Using hand gesture technique the system and devices become more familiar with the humans and they can easily communicate with these devices and system to accomplish the desire goals. Hand Gesture is based on the sign languages, which is used to interact with deaf peoples, similarly using Hand Gesture we can easily interact with the sensing devices using Hand Gestures [2]. To communicate any device using Gesture technique, there are different phases of hand gesture which represents the specific meaning to operate the devices. The focus in this paper is to design the robust model and using this model we can classify different phases of Hand Gesture technique. The model is based on the MLP. Gesture is an important tool for the communication in order to convey a message for the computer. It is a powerful technique in non-verbal communication. Corradini [3] defines a gesture as "a series of postures over a time span connected by motions". McNeill [4] describes gestures as movements of hands and arms. Dias et al. [5] describe a hand movement as a bi-dimensional curve performed by the hand in a period of time, represented as the sequence of hand positions over time. This definition corresponds to an external movement. According to Kendon[6] and McNeill[4], a gesture unit can consist of one or more gestural phrases, which can be divided into phases: preparation, stroke, hold and retraction. Stroke defines the main movement in a gestures unit and carries a semantic meaning; holds are pauses during the phrase, in which the hand configuration used in the stroke is maintained; preparation and retraction are transitory phases between the gesture units and rest positions. In this research paper we present four concepts gesture, posture, movement, and a classification of phases or the elements of hand gesture introduced by McNeill[4]. Martell and Kroll[7] considered a corpus in which gesture units are already segmented and used a Hidden Markov Model to classify each frame in preparation, stroke, hold or retraction phase.

2. MULTILAYER PERCEPTRON (MLP)

The Multilayer Perceptron consist of the multiple layers of two state sigmoid processing elements that connected using weighted connections. Multi-layered neural networks are essentially used to deal with data-sets that have a large number of features, especially non-linear ones. Intuitively, the more hidden layers it has, the more 'complex' shapes it can fit The perceptron was developed as the next model of the neuron by Rosenblatt[8], who was a physiologist, randomly interconnected the perceptrons and used trial and error to randomly change the weights in order to achieve "learning." Multilayer Perceptrons (MLPs) are able to cope with non-linearly separate problems. Historically the problem was that there were no known learning algorithms for training MLPs. So it is known to us straightforward. Backpropagation works by approximating the non-linear relationship between input and the output by adjusting the weight value internally [9]. Multilayer perceptrons based on the learning rate. The following tanning parameter as below:

Hidden layers: Hidden layers in MLPs present between the input and the output layers and they encode input signals. It can be more than one.

Learning Rate: A learning rate is a function or a fixed number that is used to train and interpret the network.

Momentum: Momentum identifies the old change of the weights. It is then added to the current change.

3. DATASET

Gesture Phase Segmentation Dataset is collected from UCI repository and one of the publicly available data set for the classification of hand gesture phase. In the dataset there are huge number of redundant record and in the dataset text file containing the different positions (coordinates x, y and z) of six articulation points left hand, right hand, left wrist, right wrist, heap and spine. The dataset contains 1747 instances, 18 numeric attributes (double), a timestamp (integer) and a class attributes (nominal) which contain five different phases like stroke, hold, preparation, retraction and rest.

4. EXPERIMENT AND RESULT

This research work done in WEKA data mining software for analysis of gesture phase segmentation data in window environment. Analysis of MLP techniques with different Tuning Parameter-

4.1 Case-1

In this research work we have used MLP as a Classifier for classification of different position of the hand. The main motive of this research work is to develop the robust classifier which classify the position of the hand with high accuracy. To develop the robust classifier we have used MLP with different learning parameters. Table-1 Shows that Accuracy of MLP model with different Training time and the value of Learning rate = 0.3, Momentum = 0.2 and seed = 1. This table shows that accuracy of the MLP model with different training time (100 to 800) and different hidden layer (HL=1to3). The accuracy of MLP model is Varying from training to training time as well as one hidden layer to another hidden layer. In case of the hidden layer-1 we achieved best classification accuracy as 81.08% with training time 200, 300, 400, 500 and 800. Similarly in case of the hidden layer-2 achieved accuracy as 82.80% with training time 600, 700 and 800. Finally in the case of the hidden layer-3 we achieved best accuracy as 82.80% with the training time 700 and 800. Figure 1 shows that the accuracy of the MLP with different training time and different hidden layer.

From the above tables we can conclude that the accuracy is varying when we change the hidden layer and training time. We have recommended MLP gives best accuracy with hiddenlayer-1 and hidden layer-3.

Table 1: Accuracy of MLP model with different Training time and Learning rate

Training Time(TT)	HL=1	HL=2	HL=3
100	80.22	82.23	81.66
200	81.08	82.52	81.66
300	81.08	82.52	81.94
400	81.08	82.52	82.23
500	81.08	82.52	82.52
600	80.80	82.80	82.52
700	80.80	82.80	82.80
800	81.08	82.80	82.80

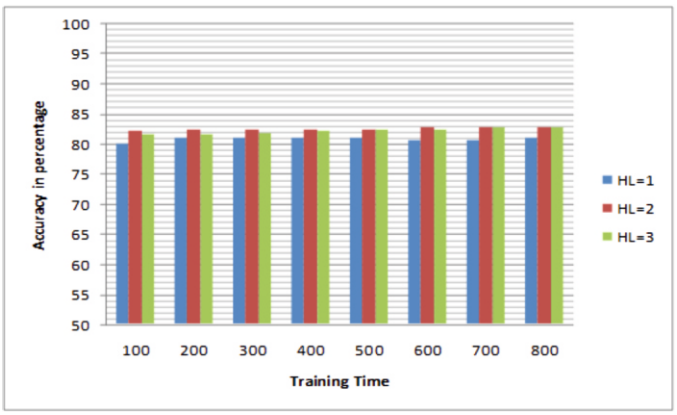

Fig. 1 Accuracy of MLP with different training times

4.1 Case-2

We have extend the research of the previous work. In this work we have used MLP technique as a classifier for the classification of the hand gesture with different learning rate and hidden layer. Table-2 shows that accuracy of the MLP model with value of training time=800, momentum=0.2 and seed=1. In this experiment we have change the learning rate from 0.1 to 0.9 with hidden layer-1,2 and 3. The accuracy of the model is varying from one hidden layer to another hidden layer and changing the learning rate. In case of the Hidden layer-1 we achieved 81.94% accuracy in case of learning rate 0.9. In case of hidden layer-2 we achieved best accuracy with learning rate 0.2, 0.3 and 0.4. Similarly in case of hidden layer-3 achieved 83.95% of accuracy with learning rate 0.6.

Finally from the above results we can conclude that MLP is robust model for the classification of hand gesture segmentation with hidden layer-3 and learning rate 0.6.

Table 2:
Accuracy of MLP model with Tainting time =800, Momentum = 0.2, seed = 1

Learning Rate	HL=1	HL=2	HL=3
0.1	80.80	81.94	82.80
0.2	80.51	82.80	82.80
0.3	81.08	82.80	82.80
0.4	81.37	82.80	83.66
0.5	81.66	82.23	83.38
0.6	81.66	82.52	83.95
0.7	81.37	81.66	83.09
0.8	81.66	81.66	83.66
0.9	81.94	80.22	80.22

5. CONCLUSION

Hand Gesture Segmentation classifies the different phases of the Hand Gesture with high accuracy in the case of Human Computer Interaction. In this paper, we developed a new robust model with the help of MLP with different training time, learning parameter and hidden layers which is used for the classification of different phases of Hand Gesture. MLP gives better accuracy as 83.95% with learning rate 0.6 and hidden layer-3.

6. REFERENCES

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